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# **SPWRTC Development Unit**

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## **User Manual**



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## REVISION HISTORY

Revision	Date	Page	Description
0.1 DRAFT	2007-05-13	All	New document/draft
0.1 DRAFT2	2007-10-20	§1.1	Updated Figure 1-1 and indicated DSU link is optional RS232 or USB-to-RS232 Converter; SMA connectors have been moved to front panel.
		§2.7	Added new USB-to-RS232 interface connection
		§3	Updated figures
		§5	Added USB connector to list and tables. Updated figure 5-1.
1.0	2008-04-10	All	Update of pictures and figures after hardware completion. Completed §4
1.1	2008-10-28	All	Formatting changed.



The interface connectors on the Front Panel of the unit provide:

- Serial DSU UART (RS232 or USB connector)
- Ethernet
- Two Spacewire interfaces
- Two CAN bus interfaces
- Two Serial UART interfaces (RS232)
- Push Buttons for *RESET* and *BREAK*
- Coaxial (SMA) type connectors for Analog Input/Output
- LED indicators

To enable convenient connection to the interfaces, the connector types and pin-outs are compatible with the standard connector types for these types of interfaces.

The interface connectors on the Back Panel of the unit provide:

- Interface connectors for General Purpose I/O (GPIO - 24 signals)
- Interface connectors for General Purpose I/O (PIO - 16 signals)
- Interface connectors for FIFO data interface
- Coaxial (SMA) type connectors for Clock inputs and Triggers
- DIP switches for system configuration

The main PCB contains the following main items as detailed in section 2 of this document:

- SPWRTC ASIC
- Memory
  - SRAM (2 banks x 2Mword x 40 Bits wide including EDAC)
  - Flash PROM (2 banks x 64Mbit organised x8 bit wide)
  - EEPROM (1 bank x 1Mbit, organised x8 bit wide)
  - additional memory via memory expansion connector
- Interfaces
  - two CAN interfaces
  - two Spacewire LVDS electrical interfaces
  - two serial UART (RS232) interfaces
  - 10/100MBit Ethernet controller and PHY
  - DSU (Serial RS232) interface
- On-board ADC and DAC circuits
  - 4 channel analog inputs with 12 bit ADC (AD1674 with ADG509)
  - 1 channel analog output with 12 bit DAC (AD667)
- Timer and Trigger Inputs/Outputs
- PIO (16 signals) and GPIO (24 signals) input/output connections
- FIFO interface connections for high speed interface via external FIFO circuit
- Power, Reset, Clock and Auxiliary circuits

## 1.2 References

- RD-1 GR-SPWRTC-DEV\_schematic.pdf, Schematic
- RD-2 GR-SPWRTC-DEV\_assy\_drawing.pdf, Assembly Drawing
- RD-3 P-ASIC-NOT-00256-SE, SpaceWire-RTC (SpwRtc) Datasheet

## 1.3 Handling



### **ATTENTION : OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES**

This unit contains sensitive electronic components which can be damaged by Electrostatic Discharges (ESD). When handling or installing the unit observe appropriate precautions and ESD safe practices.

When not in use, store the unit in an electrostatic protective container or bag.

When configuring the jumpers on the board, or connecting/disconnecting cables, ensure that the unit is in an unpowered state.

## 1.4 Abbreviations

ADC	Analog to Digital Converter
DAC	Digital to Analog Converter
DIP	Dual In-Line Plastic
ESD	Electro-Static Discharge
FIFO	First-In First-Out
FPGA	Field Programmable Gate Array
FP	Front Panel
FT	Fault-Tolerant
GPIO	General Purpose Input / Output
I/O	Input/Output
IP	Intellectual Property
LVDS	Low Voltage Digital Signalling
MUX	Multiplexer
PCB	Printed Circuit Board
SPW	Spacewire



## 2 ELECTRICAL DESIGN

### 2.1 Block Diagram

The *GR-SPWRTC-DEV* unit provides the electrical functions and interfaces as represented in the block diagram, Figure 2-1.

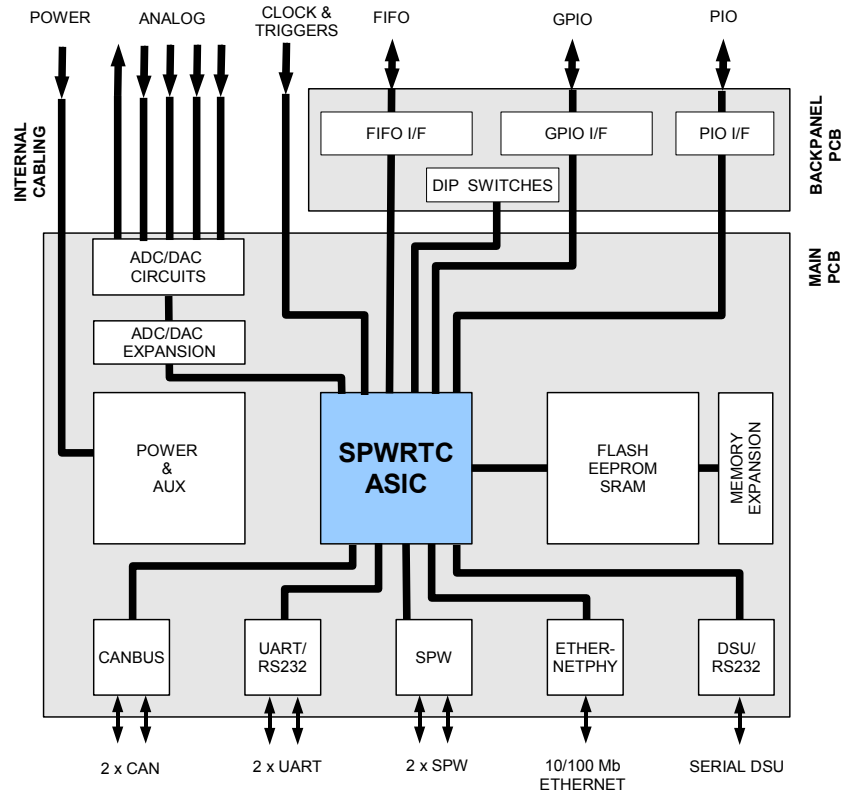


Figure 2-1: Block Diagram of GR-SPWRTC-DEV board

The Main PCB is of standard Double Eurocard format (233.35 x 160mm) and, in principle, could be used 'stand-alone' on the bench-top, without a housing. The board is also compatible with mounting in a 6U Compact PCI rack if a suitable front panel is fitted.

However, for this development, in order to provide a convenient development system, this Main PCB will be mounted in a bench-top housing. The connectors on the front edge of the Main PCB can be directly mounted to the front panel of the housing. However, a separate Back Panel PCB is required in order to accommodate the connections to the remaining interfaces and to provide mounting for the DIP switches. The two PCB's are connected by short lengths of ribbon cable.

Figure 2-2 shows the Main PCB and Figure 2-3 shows the Main PCB with 6U x 2 slot CPCI front panel mounted.

Additionally, cabling is required to connect the coaxial connectors on the Main PCB to the panel mounted connectors on the back panel and from the power connector on the back panel to the Main PCB.

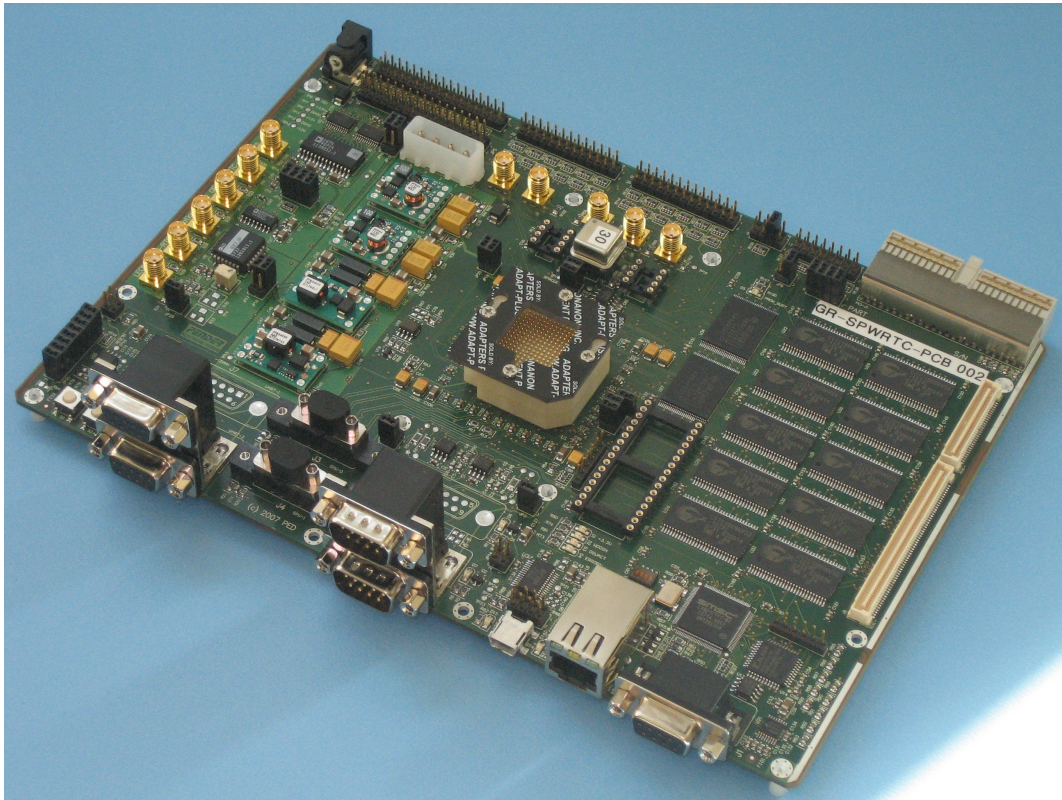


Figure 2-2: GR-SPWRTC-DEV Main PCB (stand-alone)

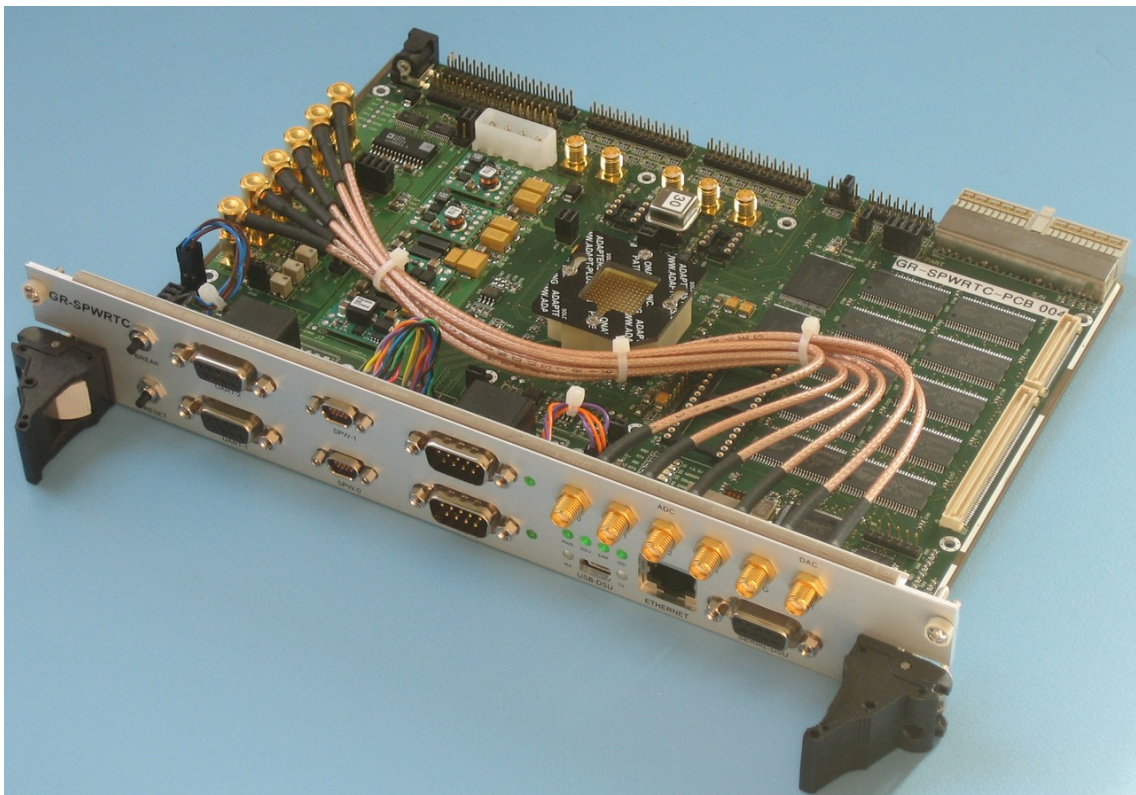


Figure 2-3: GR-SPWRTC-DEV with CPCI Front Panel

## 2.2 SPWRTC ASIC

The Main-PCB incorporates a Column Grid Array socket (type: Adapt-Plus CL349SA1912F) to accommodate the SpaceWire-RTC ASIC in its MCGA349 Column Grid Array package.

Details of the interfaces, operation and programming of the SPWRTC ASIC is given in the *SPWRTC Datasheet*, RD-3.



Figure 2-4: SPWRTC ASIC

## 2.3 Memory

The memory configuration installed on the Main PCB is shown in the figure below comprising of:

- 160Mbit of SRAM memory, organised as 2 banks x 2Mword x 40 bits wide
- 128Mbit of Flash PROM, organised as 2 banks x 8 MByte x 8 bits wide)
- 1Mbit of EEPROM organised as 1 bank x 128kByte x 8 bits wide)

Additionally, in order to allow users to install alternative memory configurations or devices, all the signals of the memory interface are connected to memory expansion connectors. The expansion connectors allow mezzanine boards to be added similar to those developed for the existing *GR-CPCI* development boards.

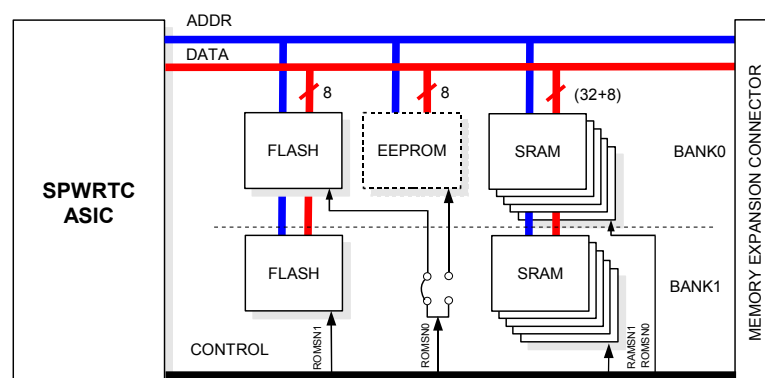


Figure 2-5: On-Board Memory Configuration



### 2.3.1 SRAM

The *GR-SPWRTC-DEV* board two SRAM memory banks has mounted as standard, each made up of five *CY7C1069AV33*. These devices are 16Mbit (2Mbyte x 8 bit devices with 10 or 12 ns access times).

The five devices provide (32 + 8) bit wide SRAM memory paths allowing EDAC operation.

These memory banks are mapped as RAMBANK0 and RAMBANK1.

In case the user wishes to disable the on board memory, this can be done by removing the jumpers JP9 on the Main-PCB.

### 2.3.2 FLASH

The *GR-SPWRTC-DEV* board has mounted as standard two FLASH memory banks, each made up of one Intel *JS28F640J3* FLASH device. These devices are 64Mbit (8Mbyte x 8 bit devices), typically with 115ns access times. The data bus width to the Flash memory is 8 bits wide. Each of the Flash devices is addressed by one of the two ROMBANK select control signals.

Note that, in Leon2 designs, the PROM width and PROM EDAC conditions are set by the state of the PIO[2..0] pins at power up of the Processor. Therefore the PIO[2..0] DIP switches on the Back Panel must be appropriately set for the correct operation of the PROM memory at start up of the processor. For information on the PIO[2..0] settings refer to the Memory Configuration documentation in the Leon2 User Manual, or RD-3.

### 2.3.3 EEPROM

The *GR-SPWRTC-DEV* board additionally has a DIP32 socket suitable for mounting an EEPROM device. The data bus width to the EEPROM device is 8 bits wide.

This socket is suitable for mounting an EEPROM device of the type *AT28LV010*, or compatible, in DIP32 package. The *AT28LV010* is an ATMEL EEPROM, of 1Mbit capacity organises as 128kByte x 8 bits.

Note though that the Leon2 memory controller design has only two ROMBANK select control signals and it is not possible to simultaneously use the EEPROM memory together with both the Flash ROM banks.

Jumpers are therefore provided to enable the user to select either the first FLASH device or the EEPROM to operate as the *ROMBANK0* device which appears at the initial memory location of 0x00000000.

## 2.4 CAN Interface

The Main-PCB provides the electrical interfaces for two CAN bus interfaces, as represented in the block diagram, Figure 2-6.

The CAN bus transceiver IC's on this board are *SN65HVD230* devices from Texas Instruments which operate from a single +3.3V power supply.

The connector interfaces are male DSUB-9 connectors adhering to the standard pin-out for this type of interface (ref. Table 5-8 And Table 5-9).

Although there are two CANBUS interfaces, inside the *SPWRTC* ASIC there is only one controller which is multiplexed between the two interfaces.

The *ENABLE* signals are used to drive LED's to provide an indication of the active CAN interface. LED's are provided on the front panel if the unit.

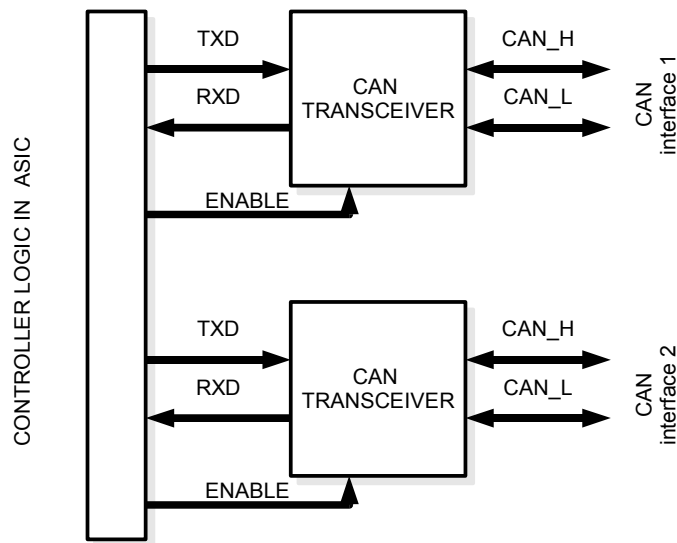


Figure 2-6: Block Diagram of the CAN interface

### 2.4.1 Configuration of Bus Termination

The CAN interfaces on the board can be configured for either end node or stub-node operation by means of the jumpers JP3 and JP4 for interface 1 and 2 respectively, as shown in Figure 2-7.

For normal end-node termination with a nominal 120 Ohm insert jumpers in position 1-3.

However, if a split termination is desired (if required for improved EMC performance), insert the jumpers in positions 1-2 and 3-4.

For stub nodes, if termination is not required, do not install any jumpers.

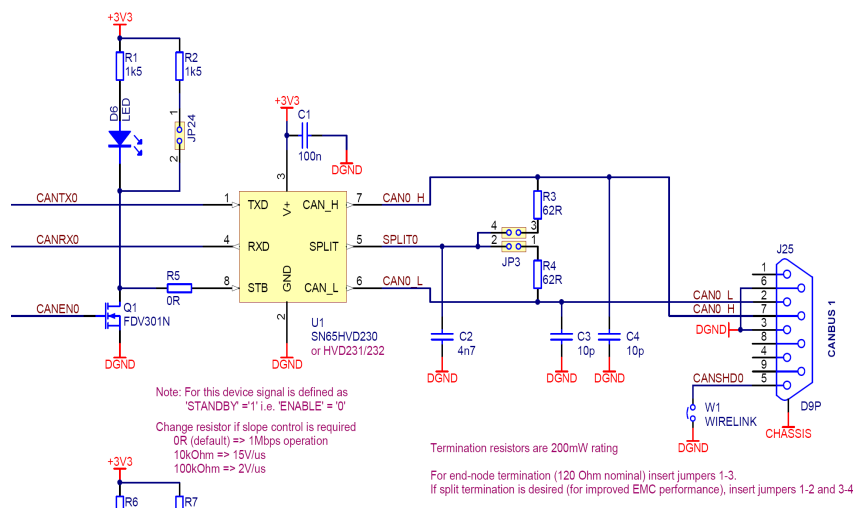


Figure 2-7: Transceiver and Termination Configuration (one of 2 interfaces shown)

### 2.4.2 Configuration of Enable/Standby Mode

The SN65HVD230 transceiver device used on the board has the facility to set the device into either *STANDBY* mode, by connecting an active high external signal to pin 8 of the device (refer to Figure 2-7).

Since the *SPWRTC* ASIC provides an active high 'enable' output, an inverter is therefore required to control the standby pin appropriately.

Conveniently this inverter can also be used to drive an LED.

A further feature provided by the SN65HVD230 device is the capability to adjust the transceiver slew rate. This can be done by modifying the values of resistors connected to pin 8 of the transceivers.

The default value of 0 ohms is compatible with 1Mbps operation.

From the data sheet the following resistor values give the following slew rates:

10kOhm => 15V/us

100kOhm => 2V/us

## 2.5 Spacewire (LVDS) Interfaces

The *SPWRTC* ASIC provides two Spacewire interfaces which are routed to the front panel of the board.

### 2.5.1 SPW interface circuit

Each Spacewire interface consists of 4 differential pairs (2 input pairs and 2 output pairs), as shown in the figure below. As the *SPWRTC* ASIC incorporates the LVDS driver/receiver structures inside the ASIC, no additional LVDS driver circuits are required on the PCB. However a 1.25V Voltage Reference circuit is required in order to provide the necessary bias voltages for the driver and receiver circuits.

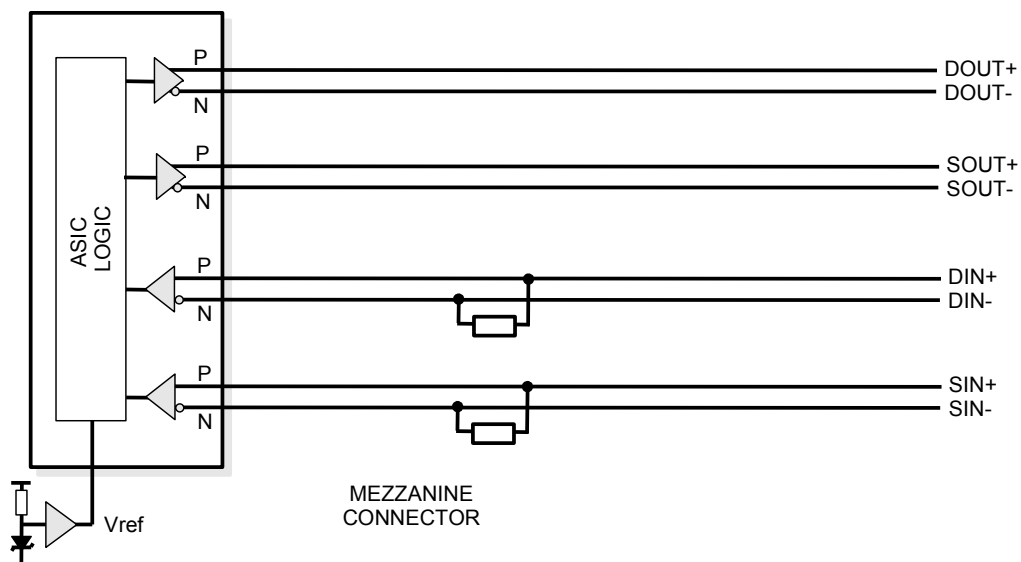


Figure 2-8: Block Diagram of the SPW interface (one of 2 interfaces shown)

During the design of the PCB care has been taken to ensure that has SIN/DIN and SOUT/DOUT pairs have matched lengths, to ensure equal propagation time for signals

The PCB traces on the *GR-SPWRTC-DEV* board are laid out with 100-Ohm differential impedance design rules.

100 Ohm Termination resistors for the LVDS receiver signals are mounted on the board.

The pin out and connector types for these Spacewire interfaces conforms to the Spacewire standard, as shown in Figure 2-9.

The inner shield pin (pin3 of the connector) is connected to DGND via a Zero-ohm resistor.

The outer shield (connector chassis) is connected to the board DGND with a 10k resistor in parallel with a 100pF capacitor. If a 'hard' connection to DGND is desired, the resistor can be replaced with a Zero-ohm resistor.

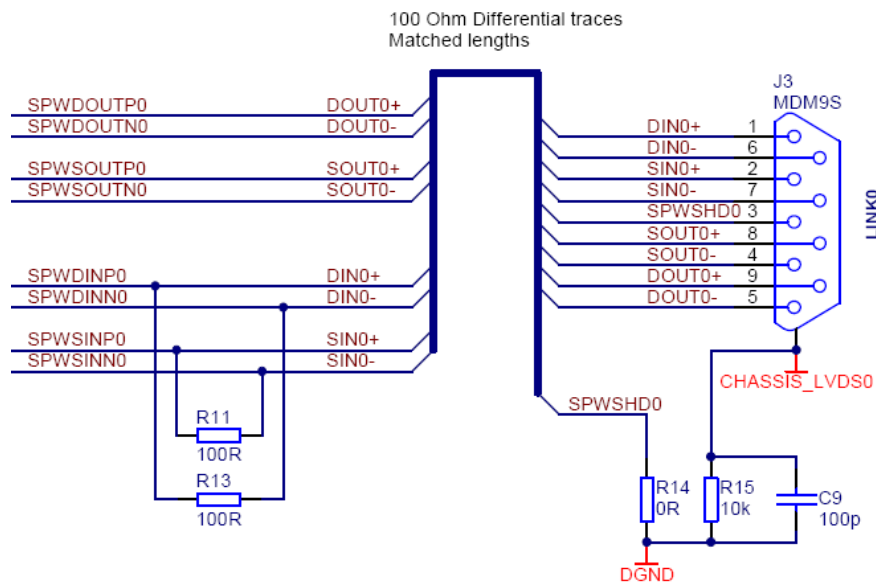


Figure 2-9: Block Diagram of the SPW interface (one of 2 interfaces shown)

## 2.5.2 SPWCLK

Configuration options on the board (jumpers, crystal socket and backpanel coaxial connector) allow this Spacewire clock to be provided from the following sources:

- Main processor oscillator X1
- Dedicated *SPWCLK* oscillator (if appropriate Oscillator X3 is mounted in socket)
  - External clock input (from back panel coaxial connector)

The default configuration is that the clock is supplied by the frequency of the main processor oscillator, with jumper JP23 installed on the board.

## 2.5.3 SPWCLK Configuration Switches

The SPWRTC design has a number of control inputs to the ASIC which are required to be set to configure the clock and PLL features of the Spacewire interface.

These configuration signals can be set by means of DIP Switches on the back panel of the Unit. The DIP switches on the Back Panel are assigned the following functions:

SPWCLKCFG0	=>	SPWCLK10Mbit0
SPWCLKCFG1	=>	SPWCLK10Mbit1
SPWCLKCFG2	=>	SPWCLK10Mbit2
SPWCLKCFG3	=>	SPWCLKMULT0
SPWCLKCFG4	=>	SPWCLKMULT1
SPWCLKCFG5	=>	SPWCLKMUXSEL
SPWCLKCFG6	=>	SPWCLKPLLCFG0
SPWCLKCFG7	=>	SPWCLKPLLCFG1
SPWCLKCFG8	=>	SPWCLKPLLCFG2

For more information on the meaning and operation of these signals, refer to RD-3.

## 2.6 Serial Interfaces and PIO

The standard Leon2 design on which the *SPWRTC* is based, provides a 16 bit Parallel Input/Output port (PIO). These 16 pins are routed from the ASIC to the Backplane PCB where external connections can be made to the PIO pins for control or monitoring of the state of the pins. Additionally on the back panel PCB, DIP switches are provided to allow a easy setting of the PIO configuration if required.

In the Leon2 design the to 8 bits of the PIO port have a dual function and can be used to provide two serial UART interfaces. The *GR-SPWRTC-DEV* design provides RS232 driver/receiver chips for these signals and routes these to front panel connectors. To enable the use of these pins for the UART functions, jumpers must be installed, and the corresponding DIP switches must be opened, as schematically represented in Figure 2-10.

The front panel connector types for the UART interfaces are Female D-Sub 9 pin types with a standard pin-out for serial links.

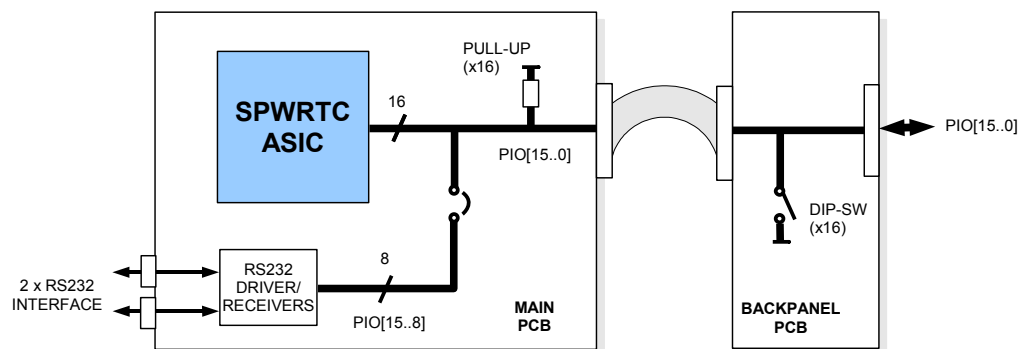


Figure 2-10: PIO and UART interface

## 2.7 Debug Support Unit (DSU) Serial Interface

The *GR-SPWRTC-DEV* unit provides a interface for Debug and control of the processor by means of a host terminal via the DSU serial link to the *SPWRTC* ASIC, as represented in Figure 2-11.



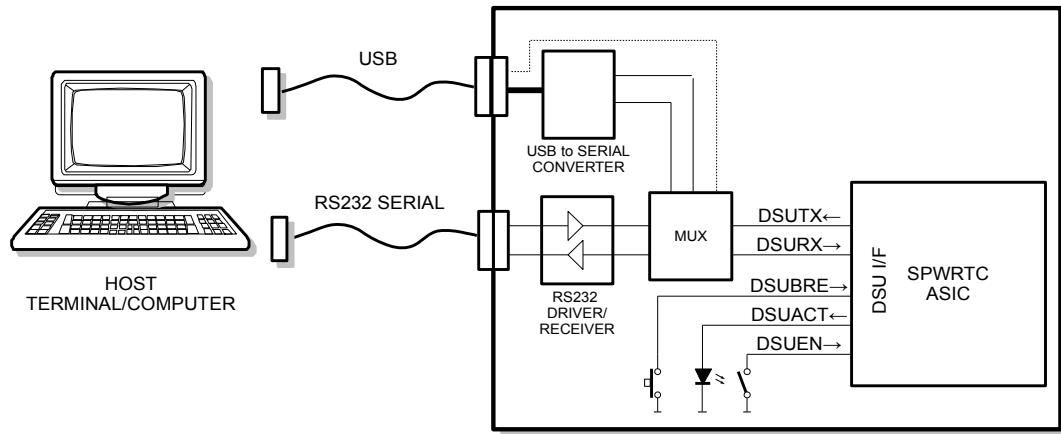


Figure 2-11: Debug Support Unit connections

The unit provides two possibilities for connecting to the Serial DSU interfaces:

1. SUB-D Female 9 pin serial connector with RS232 transceiver
2. USB MiniAB connector with USB to Serial interface chip

Spare logic in the CPLD (which is already required for the address decoding of the Ethernet interface- see section 2.11.6) is used to implement a simple multiplexer to connect the two sets of RX/TX signals to the DSURX and DSUTX signals of the *SPWRTC* ASIC chip.

The control signal for the multiplexer is derived from the +5V pin of the USB connector so that when a powered USB cable is plugged into the unit the USB cable is selected as the active DSU interface.

The baud rate of the serial link is determined by the host computer, and the DSU interface in the *SPWRTC* ASIC auto-detects and adjusts its baud rate to suit.

The *DSUENable* signal input to the processor is connected to a DIP switch on the back panel of the unit (ref. Table 5-29). In normal use the DSU feature will always be enabled to allow processor control and program debugging via the DSU link.

Two LED's are provided on the Main PCB to indicate the conditions of the *DSUACT* and *ERRORN* signals from the *SPWRTC* processor. Additionally connections are provided to two LED's indicators on the front panel of the Unit.

A miniature push button switch is provided on the Main PCB for the *DSUBREAK* control, and connections are provided to an additional push-button switch on the front panel of the unit.

## 2.8 Analog Interfaces

The *GR-SPWRTC-DEV* board includes an ADC and DAC circuits on board, intended to be used to demonstrate the operation of ADC/DAC controller IP-core which is implemented in the logic of the *SPWRTC* ASIC.

The signals of this IP-core interface are provided on connector JP5 to enable probing and monitoring of the signals.

This IP-core interface is intended to be multi-purpose, and suitable for different types of ADC/DAC components, and comprises the following signals:

ADDATA[15..0]	Bussed ADC and DAC data signals
ADADDR[7..0]	Multiplexer address signals (Also individually usable as GPIO)
ADWR	Write control signal for DAC (polarity is user-definable in <i>SPWRTC</i> ASIC)
ADCS	Chip Select (polarity is user-definable in <i>SPWRTC</i> ASIC)
ADRC	Read/Convert control for ADC (polarity is user-definable in <i>SPWRTC</i> )
ADRDY	Conversion ready signal from ADC (polarity user-definable in <i>SPWRTC</i> )
ADTRIG	External ADC Trigger input

Note that, if desired, the on-board ADC and DAC circuits can be disabled, by the removal of as set of 4 jumpers (JP10) on the board.

All the ADC/DAC interface signals from the *SPWRTC* ASIC. This allows simple interface for users to add their own Mezzanine boards with different Analog/Digital features as required.

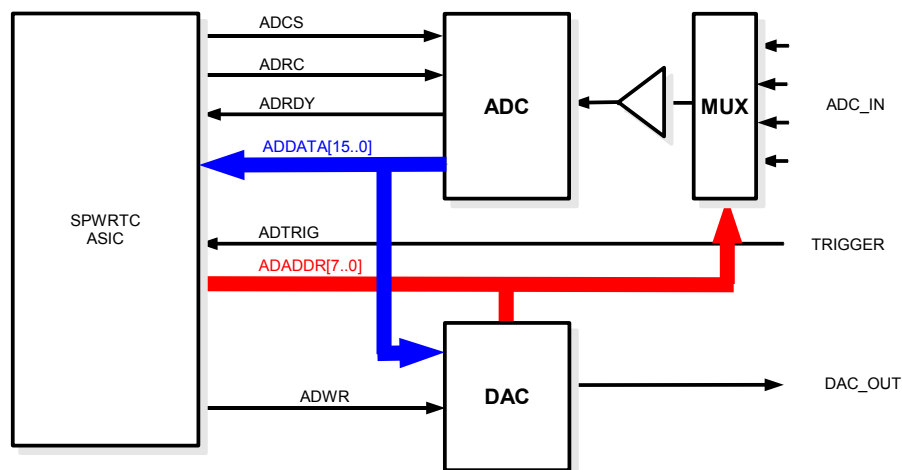


Figure 2-12: Block Diagram of the Analog Control interface

### 2.8.1 ADC Inputs

The ADC circuitry comprises a 12 bit ADC (AD1674) with a 4 channel multiplexer front-end (ADG509). For detailed operation of the ADC please refer to its datasheet.

The default configuration of the ADC is set-up to measure a bipolar -5V to +5V input voltage range. However, the circuit on the board can also be configured to provide a uni-polar 0 to +10V or input voltage range, by reconfiguration of a number of the resistors on-board.

The Multiplexer address is controlled by setting the appropriate bit-pattern on the ADADDR[5..4] signal outputs of the SPWRTC ASIC.

Note that, since the logic part of the ADC device operates from a +5V digital supply, the output data must be buffered with a level shifter circuit to ensure compatibility with the 3.3V LVTTTL inputs of the SPWRTC ASIC.

An SMA connector (J19) connects to a dedicated input signal pin of the *SPWRTC* ASIC to allow an external trigger signal to be used to initiate an ADC conversion.

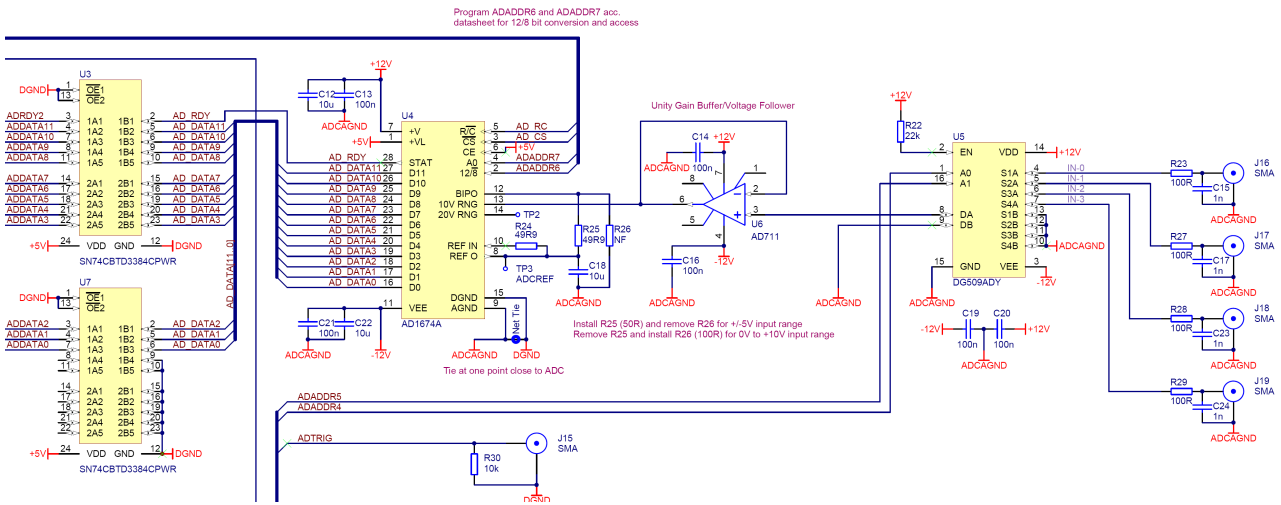


Figure 2-13: ADC Circuitry

## 2.8.2 DAC Output

The DAC circuitry comprises a single channel 12 bit DAC (AD667) .

The default configuration of the DAC is set-up to provide a bipolar -5V to +5V output voltage range. However, the circuit on the board can also be configured to provide a uni-polar 0 to +10V or 0 to +5V output voltage range, by reconfiguration of a number of the resistors on-board. Additionally Offset and Gain of the DAC circuit can be adjusted by means of the on-board potentiometers.

For detailed operation of the DAC please refer the schematic and the datasheet of the DAC device.

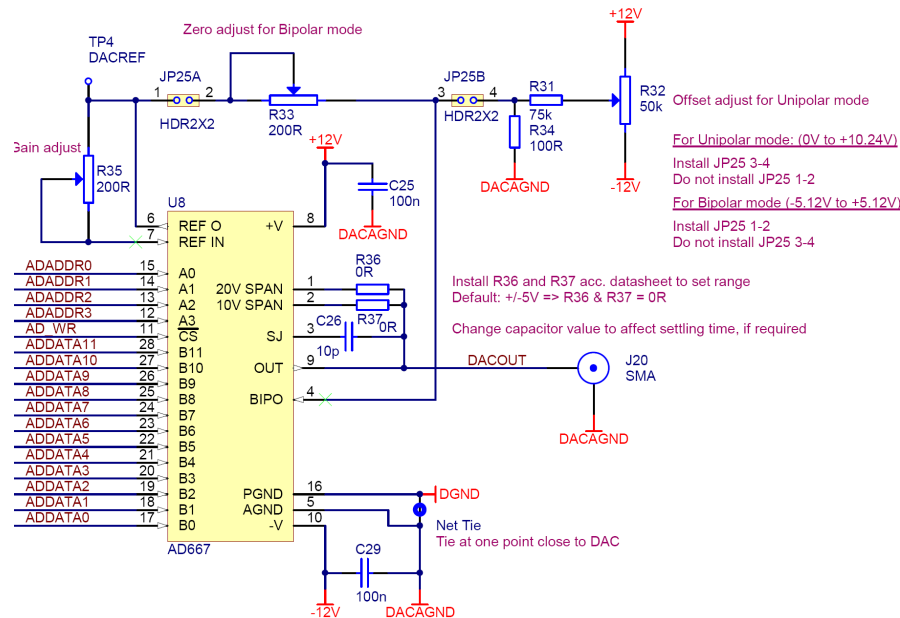


Figure 2-14: DAC Circuit

## 2.9 Oscillators and Clock Inputs

The oscillator and clock scheme for the SPWRTC ASIC is shown in Figure 2-15.

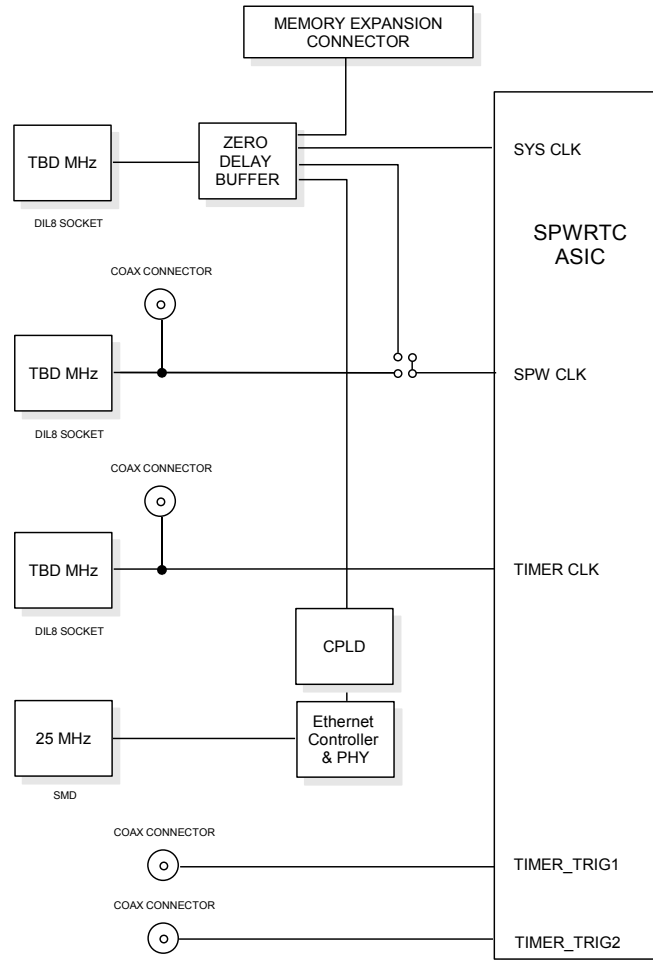


Figure 2-15: Clock Distribution Scheme

### 2.9.1 System Clock

The main oscillator for the *SPWRTC* ASIC is a 30 MHz Crystal oscillator. This oscillator will be a 4 pin DIL8 style oscillator, installed in a socket on the board. A zero-delay buffer circuit (CY2305) is used to distribute the SYSCLK.

### 2.9.2 SPW\_CLK

The *SPWCLK* can be derived from either the SYSCLK, a separate socketed on-board crystal oscillator, or can be injected on a coaxial connector on the rear panel of the unit.

### 2.9.3 TIMER\_CLK

One SMA connector (J15) is defined to allow an external clock frequency to be injected for generating the clock of the General Purpose Timers in the Leon system. Alternatively a dedicated oscillator can be installed in a DIL8 socket on the board.

### 2.9.4 Timer Triggers

Two coaxial connectors (J20 and J21) are defined for the functions of Timer Trigger inputs to allow an external equipment to generate these trigger inputs.

### 2.9.5 UART\_EXTCLK

A further coaxial connector on the rear panel (J23) is defined to allow an external clock frequency to be injected for generating the clock of the UART (serial) interface communication. This signal is connected to the PIO(3) input of the SPWRTC ASIC (see RD-3).

### 2.9.6 Ethernet Clock

A dedicated 25MHz SMD oscillator is provided for the Ethernet Controller and PHY circuit (see section 2.11.6).

## 2.10 Power Supply and Voltage Regulation

The board operates from a single +5V DC power supply input. On board regulators generate the following voltages:

- +3.3V for the SPWRTC I/O voltage, memory chip and other peripherals
- +1.8V for SPWRTC Vcore voltage
- +12V for analog circuits (ADC and DAC)
- -12V for analog circuits (ADC and DAC)

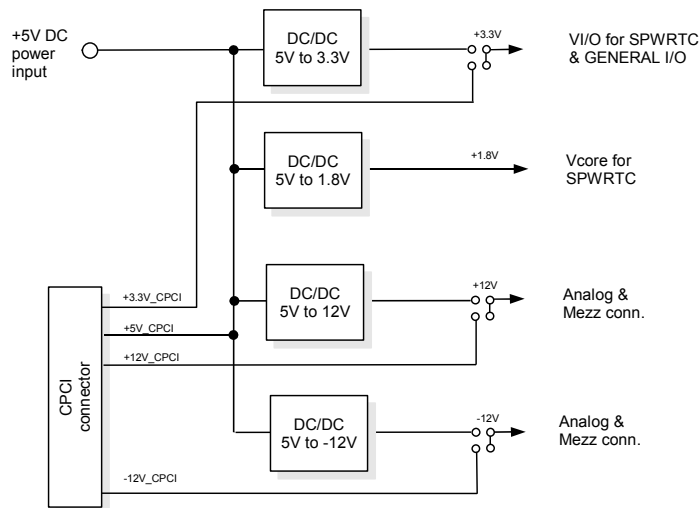


Figure 2-16: Power Supply and Voltage Regulation

All voltages +5V, +3.3V,  $\pm 12V$  are provided via the memory expansion connector interface making feasible that user defined mezzanine boards can use these voltages.

If the Main PCB is installed in a Compact PCI rack, the board can be configured by means of jumpers such that the +5V, +3.3V, +12V and -12V are provided from the Compact PCI backplane instead of the internal regulators.

## 2.11 Other Interfaces and Circuits

### 2.11.1 GPIO

The 24 general Purpose Input Output signals of the ASIC(3.3V LVTTTL voltage levels) are connected to a set of 0.1" pitch pin header connectors on the Rear Panel PCB thus allowing easy access to these signals.

Pull ups are provided on each of the signals lines on the Main PCB and additionally the Rear Panel PCB provides a set of DIP Switches allowing the user convenient programming of the signal state when the GPIO lines are configured as inputs. When programmed as outputs the DIP switches should be left in the 'open' state.

### 2.11.2 FIFO

The *SPWRTC* ASIC is equipped with a FIFO data interface for high-speed data transfer with an external device, supporting both 8 and 16 bit operational mode. A 0.1" connector header on the Rear Panel enables direct access to the digital FIFO interface of the ASIC with the following signals:

- FIFOHALFN
- FIFOFULLN
- FIFOEMPTYN
- FIFOWRN
- FIFORDN
- FIFOP[1..0]
- FIFOD[15..0]
- RESETN

Since different users may have various requirements on the type FIFO device and interface, or may want to interface an FPGA or similar device via the FIFO data interface, the *GR-SPWRTC-DEV* board itself does not include any such circuits. However, such circuits can be added by means of a small mezzanine board connecting to the Rear Panel FIFO connector.

### 2.11.3 Reset Circuit and Button

A standard Processor Power Supervisory circuit (TPS3705 or equivalent) is provided on the Main PCB to provide monitoring of the 3.3V power supply rail and to generate a clean reset signal at power up of the Unit.

To provide a manual reset of the board, a miniature push button switch is provided on the Main PCB for the control. Additionally connections are provided to an additional push-button *RESET* switch on the front panel of the unit.

### 2.11.4 Watchdog

The *SPWRTC* ASIC includes a Watchdog timer function which can be used for the purpose of generating a system reset in the event of a software malfunction or crash.

On this development board the *WDOGN* signal is connected as shown in the Figure 2-17 to the Processor Supervisory circuit.

To utilise the Watchdog feature, it is necessary to appropriately set-up and enable the Watchdog timer. Please consult the *SPWRTC* data sheet (RD-3) for the correct register locations and details.

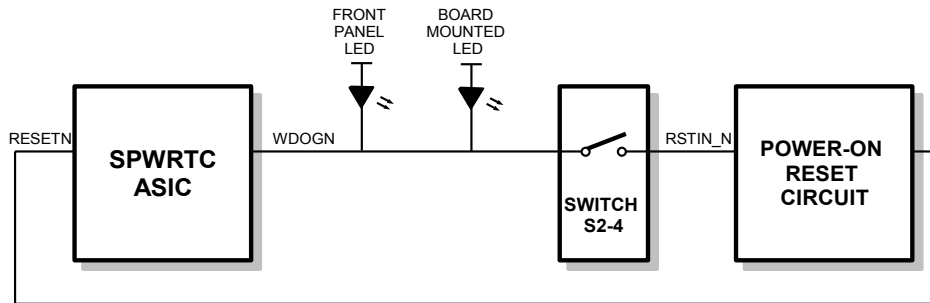


Figure 2-17: Watchdog configuration

Also, to allow the *WDOGN* signal to generate a system reset it is necessary to set the Switch S2-4 in the *CLOSED* position (see Figure 2-17).

For software development it is often convenient or necessary to disable the Watchdog triggering in order to be able to easily debug without interference from the Watchdog operation. In this case, Switch S2-4 should be in the *OPEN* position. When the watchdog triggers, the Watchdog LED's will illuminate, but a system reset will not occur.

### 2.11.5 JTAG interface

A 6 pin header on the Main PCB provides the possibility to connect to the JTAG signals and JTAG chain of the *SPWRTC* ASIC.

### 2.11.6 Ethernet Interface

The *SPWRTC* ASIC device does not incorporate a Ethernet interface. However, this functionality is implemented on the *GR-SPWRTC-DEV board* by adding an external Ethernet controller and PHY device, mapped as an I/O peripheral in the memory/I/O space of the processor.

A separate CPLD is required in order to perform the address and logic decoding for the control of the LAN91C111 device.

In the example configuration programmed into the CPLD at delivery, the registers of the Ethernet MAC+PHY are mapped at the start of the Leon I/O space at memory address *0x20000000*.

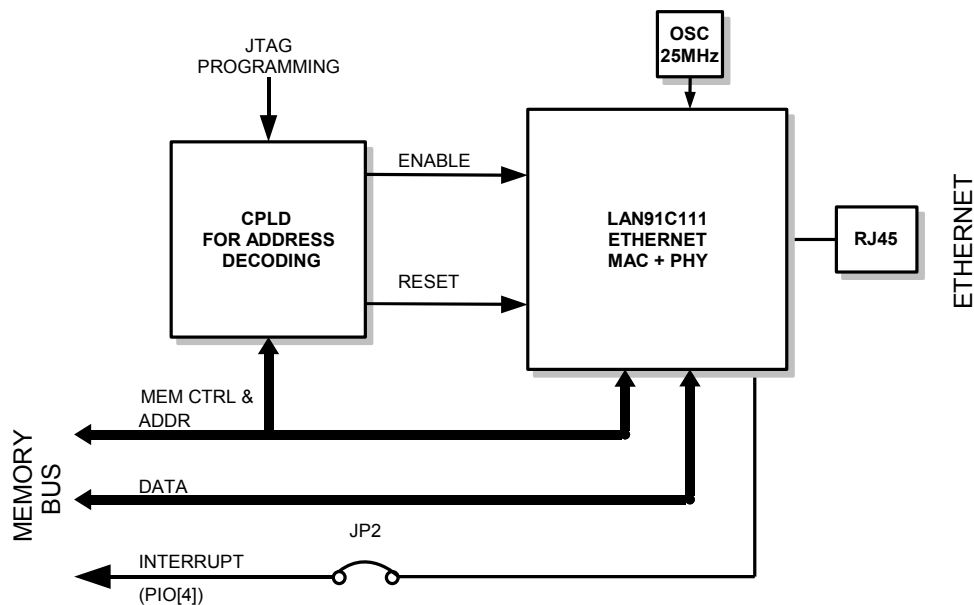


Figure 2-18: I/O Mapped Ethernet MAC + PHY

For more information on the registers and functionality of the Ethernet MAC+PHY device please refer to the data sheet for the *LAN91C111*.

To utilise the Ethernet interface, appropriate driver software will be required depending on the features and operating system which the user wishes to implement. Support for the LAN91C111 is included in the RTEMS port for the Leon processor.

The interrupt output of the Ethernet MAC is connected to the *PIO[4]* input to the *SPWRTC* ASIC. This can be disabled by removing jumper *JP2* if necessary.

The CPLD is programmed via a separate 6 pin JTAG header. However, this is not normally a user feature.

### 2.11.7 Compact PCI Connector

The Main PCB is equipped with a Compact CPI Type-A connector.

If, instead of being mounted in a housing, the Main PCB is instead equipped with a Compact PCI front panel and installed in a Compact PCI rack, the board can be configured by means of jumpers such that the +5V, +3.3V, +12V and -12V are provided from the Compact PCI backplane instead of the internal regulators. The only other signals from the CPCI interface which is connected is the 'push button reset' signal from the backplane. This allows a system reset button to generate a reset of the *GR-SPWRTC-DEV* board.

Since the *SPWRTC* ASIC does not have a PCI interface, no further functionality can be provided by the Compact PCI connector.



### 3 MECHANICAL DESIGN

The housing provides a robust mechanical enclosure and convenient connector attachment for convenient use in a laboratory or bench top environment.

The chosen housing type is: ELMA Type 33, case size 2 with depth 240mm. The overall dimensions of the unit are 256.5 x 264 x 69 mm.

This housing is convenient in that it allows a PCB with 6U compatible (i.e. Double Euro Card sized) width to be slotted into and supported by mounting rails in the housing itself.

The depth of the housing (240mm) is conveniently allows space for the backpanel PCB and internal cabling.

The standard enclosure type has been selected and has an aluminium body and plastic bezels and feet. This type of enclosure is also available in IP54 splash and dust resistant and in EMC sealed versions.

Custom aluminium front panels are required, dimensioned with the appropriate cut-outs for the connectors and indicators.

The connector types are 'standard' types allowing convenient attachment using standard laboratory equipment.

Normally, no access would be required to the PCB's inside the housing, as connectors provide connections to all the system interfaces, and rear-panel DIP switches provide configuration options for the main features. However, access to the PCB's can easily be gained by removing the rear bezel so that the rear panel can be loosened by means of 4 screws underneath the bezel. This then allows the lid to be removed without further disassembly of the unit being performed.

Figure 3-1 shows a front view of the unit, showing the main system interface connectors.

Figure 3-2 shows a rear view of the unit, highlighting the configuration DIP switches, the SMA type RF connectors for the analog and clock signals, and the FIFO/PIO and GPIO interfaces. The connector types for the FIFO/PIO and GPIO interfaces are compatible with IDC type ribbon cable connectors, and provide side latches to lock the mating connectors and ensure contact.. These type of connectors (0.1" raster pins) are also simple to connect to individual pins if simple monitoring of the states of outputs is required using lab equipment (Oscilloscope or Logic Analyser). The unit is powered with a +5V DC power source which connects to a connector on the back panel.

Figure 3-3 shows a view of the housing with the lid removed, to highlight the main and back panel PCB's.



Figure 3-1: View of Front of Housing

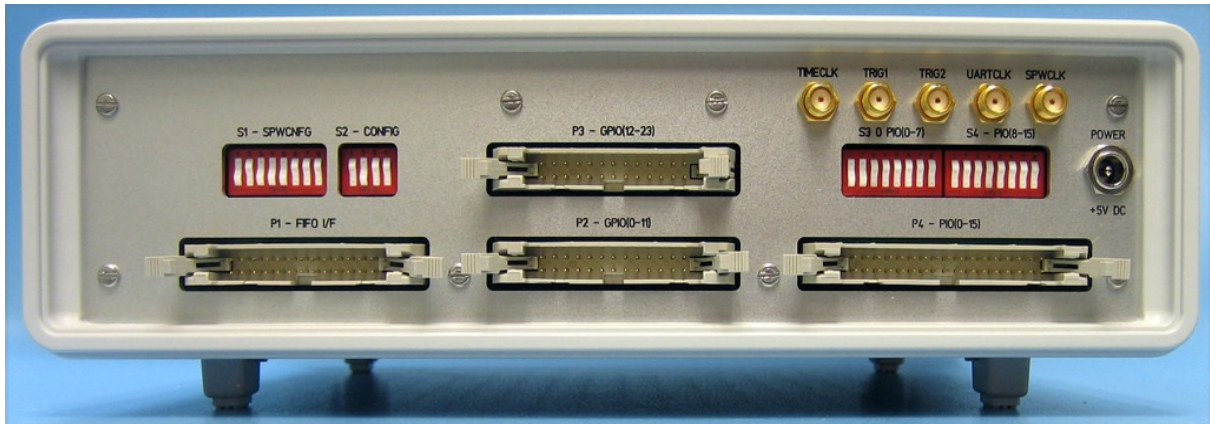


Figure 3-2: View of Rear of Housing

The connection between the main PCB and the back-panel PCB is made with 1:1 ribbon cable connections and with SMA-SMA cable assemblies of approximate length 150mm. This provides a reasonably clean and convenient hook-up, yet sufficient 'play' between the two PCB's to aid assembly/disassembly of the unit.



Figure 3-3: View showing Main PCB and Backpanel PCB

## 4 SETTING UP AND USING THE UNIT

The default status of the Jumpers on the boards is as shown in table Figure 4-1. For the meaning of the various jumpers, refer to Table 5-35 and RD 1.

	Stand-Alone Board	Boxed Version
JP1	3-4	3-4
JP2	1-2	1-2
JP3	1-2	1-2
JP4	1-2	1-2
JP5	All open	All open
JP6	All open	All open
JP7	All open	All open
JP8	1-2	1-2
JP9	All installed	All installed
JP10	All installed	All installed
JP11	1-2 and 3-4	1-2 and 3-4
JP12	Open	CPCI-LED installed
JP13	1-2	1-2
JP14	1-2 and 3-4	1-2 and 3-4
JP15	1-2	1-2
JP16	1-2	1-2
JP17	1-2	1-2
JP18	1-2	1-2
JP19	Open	Cable to FP Switch installed
JP20	1-2	1-2
JP21	All installed	All installed
JP22	1-2, 5-6, 7-8, 9-10	1-2 -5-6, 7-8, 9-10
JP23	1-2	1-2
JP24	Open	Cable to FP LED installed
JP25	1-2	1-2

Table 4-1: Default Status of Jumpers/Switches

To operate the unit, connect the +5V power supply to the Power Socket at the back of the unit.

The front-panel POWER LED should be illuminated indicating that the +3.3V power is active.

Upon power on, the Processor will start executing instructions beginning at the memory location 0x00000000, which is the start of the PROM. If the PROM is 'empty' or no valid program is installed, the first executed instruction will be invalid, and the processor will halt with an ERROR condition, with the ERROR LED illuminated.

Pressing the DSU-BREAK button should illuminate the DSUACT LED and halt the processor.

To perform software download and debugging on the processor, a link from the Host computer to the DSU interface of the board is necessary.

For PC's with a serial (SUBD-9) interface, the serial cable can be connected from the Host



PC to the J1 connector on the front Panel.

Alternatively, for PC's with only a USB interface, a connection to the DSU of the board can be made using a USB cable (Type-A to Mini-AB connectors) from the Host PC to the USB-DSU connector on the front panel.

Note, to use the USB-DSU interface you need to install the FTDI Virtual Com driver on the Host PC. This driver allows the USB connection to the board to be used as a 'virtual' serial port, operating at baud rates up to 460800 Baud.

These drivers can be downloaded from the *FTDI* web site, ([www.ftdichip.com/FTDrivers.htm](http://www.ftdichip.com/FTDrivers.htm)) and drivers for both Linux and Windows are available. Information for the installation of these drivers can be found on the *FTDI* web site

To perform program download and software debugging on the hardware it is necessary to use the Gaisler Research *GRMON* debugging software, installed on a host PC (as represented in Figure 2-11).

Note that it is necessary to use the 'PRO' version of *GRMON*, as the *SPWRTC* ASIC incorporates FT features. It is not possible to use evaluation version of *GRMON* with this ASIC. Please refer to the *GRMON* documentation for the installation of the software on the host PC (Linux or Windows), and for the installation of the associated hardware dongle.

Starting *GRMON*, with the command:

```
grmon -i
```

will establish a link to the DSU, and will initialise the processor registers and timers.

The default serial interface used by *GRMON* is */dev/ttyS0* (linux) or *com1* (Windows).

To use a different serial interface, specify the command

```
grmon -i -uart /dev/comXX
```

where *XX* is the number of the com port.

The resulting response generated on the Host Computer is shown in Figure 4-1.

Typing the command *flash* will reported the detected Flash Prom memory configuration and *info sys* will provide more information on the processors registers and internal cores as shown in Figure 4-2.

Program download and debugging can be performed in the usual manner. More information on the usage, commands and debugging features of *GRMON*, is given in the *GRMON Users Manual* and associated documentation.

```

Shell - Konsole <2>
rpenden@dieseldong:~$ grmon-full-1.1.19/grmon -i

GRMON LEON debug monitor v1.1.19

Copyright (C) 2004,2005 Gaisler Research - all rights reserved.
For latest updates, go to http://www.gaisler.com/
Comments or bug-reports to support@gaisler.com

using port /dev/ttyS0 @ 115200 baud

initialising .....
detected frequency: 30 MHz
GRLIB build version: 1212

Component                                Vendor
LEON2 SPARC V8 processor                  European Space Agency
AHB Debug UART                           European Space Agency
FIFO Controller                           Gaisler Research
UoD SpaceWire link                        European Space Agency
UoD SpaceWire link                        European Space Agency
UoD SpaceWire link                        European Space Agency
UoD SpaceWire link                        European Space Agency
ESA HurriCANE CAN with DMA                Gaisler Research
AHB/APB Bridge                            Gaisler Research
LEON2 Memory Controller                   European Space Agency
LEON2 Debug Support Unit                  Gaisler Research
FT AHB static ram                         Gaisler Research
LEON2 Peripheral Bus                      European Space Agency
GPIO with Pulses                          Gaisler Research
Modular Timer Unit                       Gaisler Research
ADC/DAC Interface                         Gaisler Research
LEON2 AHB Status & Failing Addr            European Space Agency
LEON2 Write Protection                    European Space Agency
LEON2 Configuration register              European Space Agency
LEON2 Timer Unit                          European Space Agency
LEON2 UART                                European Space Agency
LEON2 UART                                European Space Agency
LEON2 Interrupt Ctrl                      European Space Agency
LEON2 I/O port                            European Space Agency
LEON2 Secondary Interrupt Ctrl             European Space Agency

Use command 'info sys' to print a detailed report of attached cores

grlib> fl

Intel-style 8-bit flash on D[31:24]

Manuf.   Intel
Device   MT28F640J3

Device ID 2231ffffa8012346
User ID  ffffffff

1 x 8 Mbyte = 8 Mbyte total @ 0x00000000

CFI info
flash family : 1
flash size   : 64 Mbit
erase regions : 1
erase blocks : 64
write buffer  : 32 bytes
region 0     : 64 blocks of 128 Kbytes

grlib> info sys
00.04:002 European Space Agency LEON2 SPARC V8 processor (ver 0)
          ahb master 0
          apb: 80000014 - 80000018
01.04:013 European Space Agency AHB Debug UART (ver 0)
          ahb master 1
          apb: 800000c0 - 800000d0
          baud rate 115200, ahb frequency 30.00

```

Figure 4-1: GRMON Output Screenshot #1

```

Shell - Konsole <2>
    ahb master 1
    apb: 800000c0 - 800000d0
    baud rate 115200, ahb frequency 30.00
02.01:035 Gaisler Research FIFO Controller (ver 0)
    ahb master 2, irq 6
    apb: 80050000 - 80050100
03.04:012 European Space Agency UoD SpaceWire link (ver 0)
    ahb master 3, irq 13
    apb: 80060000 - 80061000
04.04:012 European Space Agency UoD SpaceWire link (ver 0)
    ahb master 4, irq 15
    apb: 80070000 - 80071000
05.04:012 European Space Agency UoD SpaceWire link (ver 0)
    ahb master 5
06.04:012 European Space Agency UoD SpaceWire link (ver 0)
    ahb master 6
07.01:034 Gaisler Research ESA HurriCANE CAN with DMA (ver 0)
    ahb master 7, irq 17
    apb: 80080000 - 80080400
00.01:006 Gaisler Research AHB/APB Bridge (ver 0)
    ahb: 80000000 - 80100000
01.04:00f European Space Agency LEON2 Memory Controller (ver 0)
    ahb: 00000000 - 20000000
    ahb: 20000000 - 40000000
    ahb: 40000000 - 80000000
    apb: 80000000 - 00000000
    8-bit prom @ 0x00000000
    32-bit static ram: 2 * 8192 kbyte @ 0x40000000
    32-bit sdram: 2 * 64 Mbyte @ 0x60000000, col 12, cas 2, ref 7.7 us
02.01:002 Gaisler Research LEON2 Debug Support Unit (ver 0)
    ahb: 90000000 - a0000000
    trace buffer 512 lines, stack pointer 0x40ffffff0
    CPU#0 win 8, hwbp 4, V8 mul/div, lddel 1, meiko FPU
    icache 1 * 4 kbyte, 32 byte/line rnd
    dcache 1 * 4 kbyte, 16 byte/line rnd
03.01:050 Gaisler Research FT AHB static ram (ver 10)
    ahb: a0000000 - a0100000
    apb: 80010000 - 80010100
    64 kbyte AHB ram @ 0xa0000000
00.04:003 European Space Agency LEON2 Peripheral Bus (ver 0)
    apb: 80000000 - 80000100
02.01:037 Gaisler Research GPIO with Pulses (ver 0)
    irq 1
    apb: 80020000 - 80020100
03.01:038 Gaisler Research Modular Timer Unit (ver 1)
    irq 2
    apb: 80030000 - 80030100
    10-bit scaler, 2 * 32-bit timers, divisor 30
04.01:036 Gaisler Research ADC/DAC Interface (ver 0)
    irq 4
    apb: 80040000 - 80040100
00.04:017 European Space Agency LEON2 AHB Status & Failing Addr (ver 0)
    apb: 8000000c - 80000010
01.04:018 European Space Agency LEON2 Write Protection (ver 0)
    apb: 8000001c - 80000020
02.04:008 European Space Agency LEON2 Configuration register (ver 0)
    apb: 80000024 - 80000028
    val: 5075abd1
03.04:006 European Space Agency LEON2 Timer Unit (ver 0)
    apb: 80000040 - 80000070
04.04:007 European Space Agency LEON2 UART (ver 0)
    apb: 80000070 - 80000080
    baud rate 38400
05.04:007 European Space Agency LEON2 UART (ver 0)
    apb: 80000080 - 80000090
    baud rate 38400
06.04:005 European Space Agency LEON2 Interrupt Ctrl (ver 0)
    apb: 80000090 - 800000a0
07.04:009 European Space Agency LEON2 I/O port (ver 0)
    apb: 800000a0 - 800000ac
08.04:016 European Space Agency LEON2 Secondary Interrupt Ctrl (ver 0)
    apb: 800000b0 - 800000bc
grlib>

```

Figure 4-2: GRMON Output Screenshot #2

## 5 INTERFACES AND CONFIGURATION

### 5.1 List of Front/Back Panel Connectors

Name	Function	Type	Description
J1	DSU	D9 FEMALE	Debug Support Unit serial connections
J2	ETHERNET	RJ45	10/100Mbit/s Ethernet Connector
J3	SPW-0	MDM9-S (female)	LVDS connections for Spacewire Interface-2
J4	SPW-1	MDM9-S (female)	LVDS connections for Spacewire Interface-1
J5	CANBUS-0	D9-P (male)	Connections for CANBUS-0 interface
J6	CANBUS-1	D9-P (male)	Connections for CANBUS-1 interface
J7	UART-1	D9-S (Female)	Connections for Serial UART-1 (RS232)
J8	UART-2	D9-S (Female)	Connections for Serial UART-2 (RS232)
J9	POWER-IN	2.1mm center +ve	+5V DC power input connector
P1	FIFO-IF	26 pin 0.1" Header	Pin connections for External FIFO interface
P2	GPIO[11..0]	26 pin 0.1" Header	Pin connections for GPIO signals 0 to 11
P3	GPIO[23..12]	26 pin 0.1" Header	Pin connections for GPIO signals 12 to 23
P4	PIO[15..0]	34 pin 0.1" Header	Pin connections for PIO signals 0 to 15
J10	SPW_CLK	SMA-JACK	Input for External SPW clock signal
J11	UART_EXTCLK	SMA-JACK	Input for External UART clock signal
J12	GP_EXTCLK	SMA-JACK	General Purpose Clock input
J13	TIMETRIG1	SMA-JACK	Timer 1 Trigger Output
J14	TIMETRIG2	SMA-JACK	Timer 2 Trigger Output
J15	ADC_TRIG	SMA-JACK	ADC Trigger Input
J16	ADC_IN0	SMA-JACK	Analog Mux input Channel 0
J17	ADC_IN1	SMA-JACK	Analog Mux input Channel 1
J18	ADC_IN2	SMA-JACK	Analog Mux input Channel 2
J19	ADC_IN3	SMA-JACK	Analog Mux input Channel 3
J20	DAC_OUT	SMA-JACK	Analog (DAC) Out

Table 5-1: List of Front/Back Panel Connectors

Name	Function	Description
S1	RESET	Push button RESET switch
S2	DSU_BREAK	Push button DSU_BREAK switch
S3	SPWCLKCNFG	8 pole DIP switch for SPW configuration
S4	CONFIG	4 pole DIP switch for general configuration
S5	PIO[7..0]	8 pole DIP switch for PIO configuration, bits 0 to 7
S6	PIO[15..8]	8 pole DIP switch for PIO configuration, bits 8 to 15

Table 5-2: List and definition of Front/Back Panel Switches

Name	Function	Description
D1	POWER (3.3V)	Power indicator
D2	ERRORN	Leon processor in 'ERROR' mode
D3	DSUACT	Leon Debug Support Unit 'Active'
D4	WDOG	Watchdog indicator.
D6	CAN-A	CAN interface A enabled
D7	CAN-B	CAN interface B enabled
D14	USB-RX	Indicates activity on USB RX data
D15	USB-TX	Indicates activity on USB TX data

Table 5-3: List and definition of Front Panel LED's



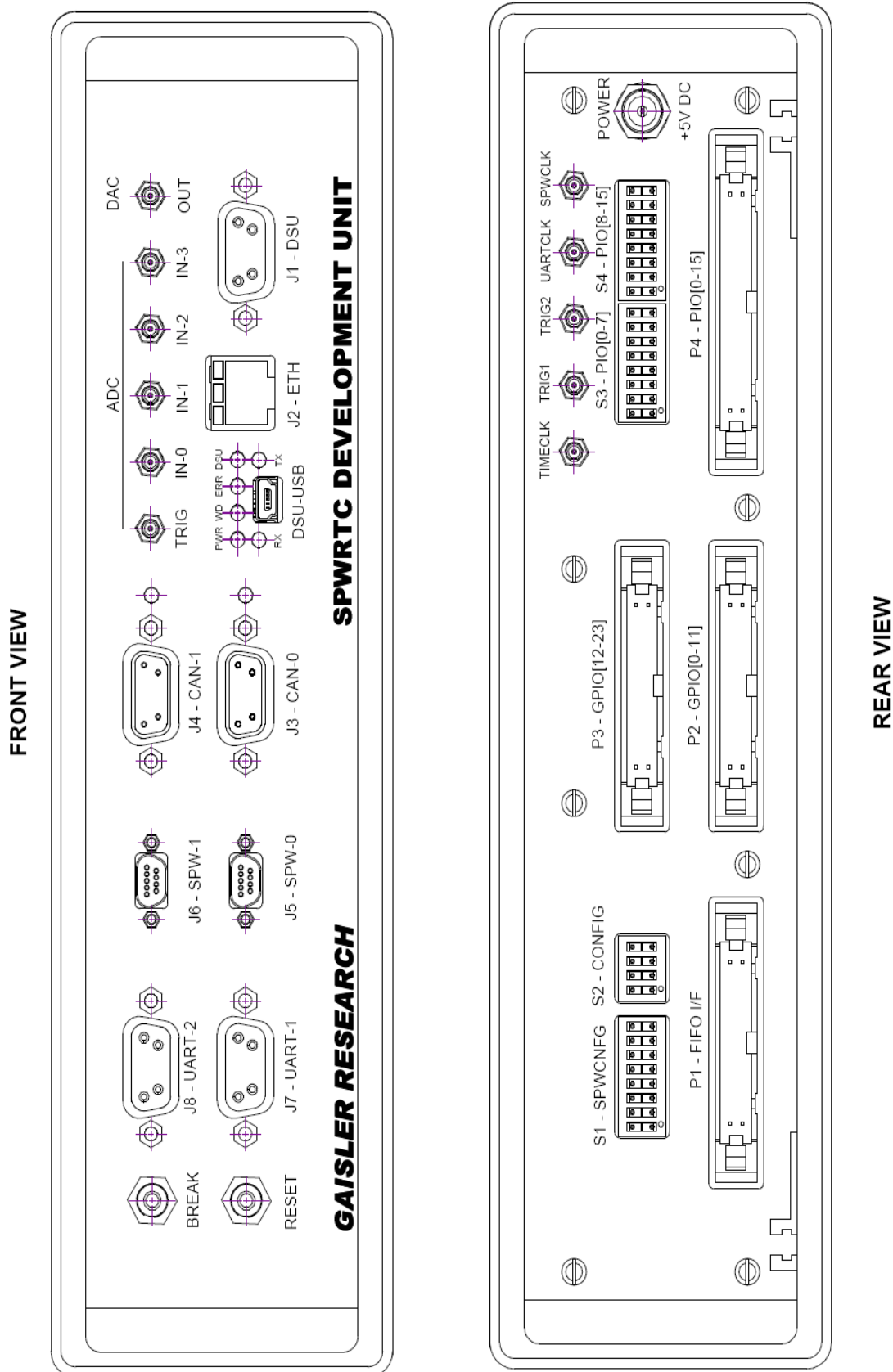


Figure 5-1: Front and Back Panel View

Pin	Name	Comment
1		No connect
6		No connect
2	DSU-TX	Transmit pin from DSU UART
7		No connect
3	DSU-RX	Receive pin to DSU UART
8		No connect
4		No connect
9		No connect
5	GND	Ground

Table 5-4: J1 DSU - Debug Support Unit connections

Pin	Name	Comment
1	TPFOP	Output +ve
2	TPFON	Output -ve
3	TPFIP	Input +ve
4	TPFOC	Output centre-tap
5		No connect
6	TPFIN	Input -ve
7	TPFIC	Input centre-tap
8		No connect

Table 5-5: J2 RJ45-ETHERNET Connector

Pin	Name	Comment
1	DIN0+	Data In +ve
6	DIN0-	Data In -ve
2	SIN0+	Strobe In +ve
7	SIN0-	Strobe In -ve
3	SHIELD	Inner Shield
8	SOUT0+	Strobe Out +ve
4	SOUT0-	Strobe Out -ve
9	DOUT0+	Data Out +ve
58	DOUT0-	Data Out -ve

Table 5-6: J3 SPW-0 interface connections

Pin	Name	Comment
1	DIN1+	Data In +ve
6	DIN1-	Data In -ve
2	SIN1+	Strobe In +ve
7	SIN1-	Strobe In -ve
3	SHIELD	Inner Shield
8	SOUT1+	Strobe Out +ve
4	SOUT1-	Strobe Out -ve
9	DOUT1+	Data Out +ve
5	DOUT1-	Data Out -ve

Table 5-7: J4 SPW-1 interface connections

Pin	Name	Comment
1		No connect
6	DGND	Ground
2	CAN0_L	CAN Dominant Low
7	CAN0_H	CAN Dominant High
3	DGND	Ground
8		No connect
4		No connect
9		No connect
5	CANSHD0	Shield

Table 5-8: J5 CANBUS-0 interface connections

Pin	Name	Comment
1		No connect
6	GND	Ground
2	CAN1_L	CAN Dominant Low
7	CAN1_H	CAN Dominant High
3	GND	Ground
8		No connect
4		No connect
9		No connect
5	CANSHD1	Shield

Table 5-9: J6 CANBUS-1 interface connections

Pin	Name	Comment
1		No connect
6		No connect
2	TXD-1	Transmit pin
7	CTSN-1	Clear To Send (active low)
3	RXD-1	Receive pin
8	RTSN-1	Request to Send (active ;ow)
4		No connect
9		No connect
5	GND	Ground

Table 5-10: J7 UART-1 - Serial Interface (RS232) connections

Pin	Name	Comment
1		No connect
6		No connect
2	TXD-2	Transmit pin
7	CTSN-2	Clear To Send (active low)
3	RXD-2	Receive pin
8	RTSN-2	Request to Send (active ;ow)
4		No connect
9		No connect
5	GND	Ground

Table 5-11: J8 UART-2 - Serial Interface (RS232) connections

Pin	Name	Comment
+VE	+5V	Inner Pin, 5V, typically 1A
-VE	GND	Outer Pin Return

Table 5-12: J9 POWER – External Power Connector

Pin	Name	Comment
1	SPW_CLK	LVTTTL input
outer	SHD	DGND

Table 5-13: J10 SPW External Clock Input

Pin	Name	Comment
1	UART_EXTCLK	LVTTTL input
outer	SHD	DGND

Table 5-14: J11 UART External Clock Input

Pin	Name	Comment
1	GP_EXTCLK	LVTTL input
outer	SHD	DGND

Table 5-15: J12 General Purpose External Clock signal

Pin	Name	Comment
1	TIMETRIG1	LVTTL input
outer	SHD	DGND

Table 5-16: J13 Timer Trigger 1 Input

Pin	Name	Comment
1	TIMETRIG2	LVTTL input
outer	SHD	DGND

Table 5-17: J14 Timer Trigger 2 Input

Pin	Name	Comment
1	ADC_TRIG	LVTTL input
outer	SHD	DGND

Table 5-18: J15 Analog to Digital Conversion Trigger

Pin	Name	Comment
1	ADC_IN0	Analog -10V to +10V input (depending on range settings)
outer	SHD	DGND

Table 5-19: J16 ADC\_IN0 Input

Pin	Name	Comment
1	ADC_IN1	Analog -10V to +10V input (depending on range settings)
outer	SHD	DGND

Table 5-20: J17 ADC\_IN1 Input

Pin	Name	Comment
1	ADC_IN2	Analog -10V to +10V input (depending on range settings)
outer	SHD	DGND

Table 5-21: J18 ADC\_IN2 Input

Pin	Name	Comment
1	ADC_IN3	Analog -10V to +10V input (depending on range settings)
outer	SHD	DGND

Table 5-22: J19 ADC\_IN3 Input

Pin	Name	Comment
1	DAC_OUT	Analog -10V to +10V output (depending on range settings)
outer	SHD	DGND

Table 5-23: J20 DAC output

FUNCTION	CONNECTOR PIN	FUNCTION
FIFOHALFN	1	FIFOEMPTYN
FIOFULLN	3	FIFOWRN
FIFORDN	5	FIFOP1
FIFOP0	7	FIFOD15
FIFOD14	9	FIFOD13
FIFOD12	11	FIFOD11
FIFOD10	13	FIFOD9
FIFOD8	15	FIFOD7
FIFOD6	17	FIFOD5
FIFOD4	19	FIFOD3
FIFOD2	21	FIFOD1
FIFOD0	23	RESETN
+3.3V	25	DGND

Table 5-24: P1 FIFO Header Pin out

FUNCTION	CONNECTOR PIN	FUNCTION
GPIO0	1	FIFOEMPTYN
GPIO1	3	FIFOWRN
GPIO2	5	FIFOP1
GPIO3	7	FIFOD15
GPIO4	9	FIFOD13
GPIO5	11	FIFOD11
GPIO6	13	FIFOD9
GPIO7	15	FIFOD7
GPIO8	17	FIFOD5
GPIO9	19	FIFOD3
GPIO10	21	FIFOD1
GPIO11	23	RESETN
+3.3V	25	DGND

Table 5-25: P2 GPIO[11..0] Header Pin out

FUNCTION	CONNECTOR PIN		FUNCTION
GPIO12	1	2	DGND
GPIO13	3	4	DGND
GPIO14	5	6	DGND
GPIO15	7	8	DGND
GPIO16	9	10	DGND
GPIO17	11	12	DGND
GPIO18	13	14	DGND
GPIO19	15	16	DGND
GPIO20	17	18	DGND
GPIO21	19	20	DGND
GPIO22	21	22	DGND
GPIO23	23	24	DGND
+3.3V	25	26	DGND

Table 5-26: P3 GPIO[23..12] Header Pin out

FUNCTION	CONNECTOR PIN		FUNCTION
PIO0	1	2	DGND
PIO1	3	4	DGND
PIO2	5	6	DGND
PIO3	7	8	DGND
PIO4	9	10	DGND
PIO5	11	12	DGND
PIO6	13	14	DGND
PIO7	15	16	DGND
PIO8	17	18	DGND
PIO9	19	20	DGND
PIO10	21	22	DGND
PIO11	23	24	DGND
PIO12	25	26	DGND
PIO13	27	28	DGND
PIO14	29	30	DGND
PIO15	31	32	DGND
+3.3V	33	34	DGND

Table 5-27: P4 PIO Header Pin out

FUNCTION	OPEN	SWITCH	CLOSED
SPWCLK10Mbit0	'1'	1	'0'
SPWCLK10Mbit1	'1'	2	'0'
SPWCLK10Mbit2	'1'	3	'0'
SPWCLKMULT0	'1'	4	'0'
SPWCLKMULT1	'1'	5	'0'
SPWCLKMUXSEL	'1'	6	'0'
SPWCLKPLLCFG0	'1'	7	'0'
SPWCLKPLLCFG1	'1'	8	'0'

Table 5-28: DIP Switch S1 'SPWCLKCNFG' definition

FUNCTION	OPEN	SWITCH	CLOSED
SPWCLKPLLCFG2	'1'	1	'0'
DSU enable	ENABLE	2	DISABLE
PROM Write Enavle	ENABLE	3	DISABLE
Watchdog Reset	DISABLE	4	ENABLE

Table 5-29: DIP Switch S2 'CONFIG' definition

FUNCTION	OPEN	SWITCH	CLOSED
PIO0	'1'	1	'0'
PIO1	'1'	2	'0'
PIO2	'1'	3	'0'
PIO3	'1'	4	'0'
PIO4	'1'	5	'0'
PIO5	'1'	6	'0'
PIO6	'1'	7	'0'
PIO7	'1'	8	'0'

Table 5-30: DIP Switch S3 'PIO[7..0]' definition

FUNCTION	OPEN	SWITCH	CLOSED
PIO8	'1'	1	'0'
PIO9	'1'	2	'0'
PIO10	'1'	3	'0'
PIO11	'1'	4	'0'
PIO12	'1'	5	'0'
PIO13	'1'	6	'0'
PIO14	'1'	7	'0'
PIO15	'1'	8	'0'

Table 5-31: DIP Switch S4 'PIO[15..8]' definition



## 5.2 List of Connectors and Jumpers on Main PCB

Name	Function	Type	Description
J1	DSU-SERIAL	D9 FEMALE	Debug Support Unit serial connections
J2	ETHERNET	RJ45	10/100Mbit/s Ethernet Connector
J3	SPW-0	MDM9-S (female)	LVDS connections for Spacewire Interface-2
J4	SPW-1	MDM9-S (female)	LVDS connections for Spacewire Interface-1
J5	CANBUS-0	D9-P (male)	Connections for CANBUS-0 interface
J6	CANBUS-1	D9-P (male)	Connections for CANBUS-1 interface
J7	UART 1	D9S (Female)	Connections for Serial UART-1 (RS232)
J8	UART 2	D9S (Female)	Connections for Serial UART-2 (RS232)
J9	MEZZ-0	AMP 5-179009-5	Expansion connector signals for Memory (120 pin, 0.8mm pitch PCB connector)
J10	POWER-IN	2.1mm center +ve	+5V DC power input connector
J11	MEZZ-1	AMP 5-179009-2	Expansion connector signals for Memory (60 pin, 0.8mm pitch PCB connector)
J12	TIMECLK	SMA-JACK	Input for External TIMER clock signal
J13	TIMETRIG1	SMA-JACK	Timer 1 Trigger Output
J14	TIMETRIG2	SMA-JACK	Timer 2 Trigger Output
J15	ADC_TRIG	SMA-JACK	ADC Trigger Input
J16	ADC_IN0	SMA-JACK	Analog Mux input Channel 0
J17	ADC_IN1	SMA-JACK	Analog Mux input Channel 1
J18	ADC_IN2	SMA-JACK	Analog Mux input Channel 2
J19	ADC_IN3	SMA-JACK	Analog Mux input Channel 3
J20	DAC_OUT	SMA-JACK	Analog (DAC) Out
J21	UART_EXTCLK	SMA-JACK	Input for External UART clock signal
J22	SPW_CLK	SMA-JACK	Input for External SPW clock signal
J23	JTAG-ASIC	6 pin 0.1" Header	JTAG interface header for ASIC
J24	JTAG-CPLD	6 pin 0.1" Header	JTAG Programming header for CPLD
J25	DSU-USB	Mina-USB-B	Miniature USB -B style connector
J26	POWER-IN'	Mate-N-Lok 4pin	Alternative power input for 4 pin IDE style connector
CPCI-J1	CPCI (Power)	CPCI Type A	CPCI connector (for power and Rset only)

Table 5-32: List of PCB Connectors

FUNCTION	CONNECTOR PIN	FUNCTION
DGND	1 120	DGND
+5V	2 119	+5V
DGND	3 118	DGND
-12V	4 117	-12V
DGND	5 116	DGND
+12V	6 115	+12V
DGND	7 114	DGND
D15	8 113	D31
D7	9 112	D23
+3.3V	10 111	+3.3V
DGND	11 110	DGND
D14	12 109	D30
D6	13 108	D22
D13	14 107	D29
D5	15 106	D21
D12	16 105	D28
D4	17 104	D20
D11	18 103	D27
D3	19 102	D19
+3.3V	20 101	+3.3V
DGND	21 100	DGND
D10	22 99	D26
D2	23 98	D18
D9	24 97	D25
D1	25 96	D17
D8	26 95	D24
D0	27 94	D16
A26	28 93	A27
A24	29 92	A25
+3.3V	30 91	+3.3V
DGND	31 90	DGND
A22	32 89	A23
A20	33 88	A21
A18	34 87	A19
A16	35 86	A17
A14	36 85	A15
A12	37 84	A13
A10	38 83	A11
A8	39 82	A9
+3.3V	40 81	+3.3V
DGND	41 80	DGND
A6	42 79	A7
A4	43 78	A5
A2	44 77	A3
A0	45 76	A1
WRITEN	46 75	READ
OEN	47 74	IOSN
ROMSN0	48 73	ROMSN1
RAMSN4	49 72	RAMOEN4
+3.3V	50 71	+3.3V
DGND	51 70	DGND
RAMSN3	52 69	RAMOEN3
RAMSN2	53 68	RAMOEN2
RAMSN1	54 67	RAMOEN1
RAMSN0	55 66	RAMOEN0
RWEN2	56 65	RWEN3
RWEN0	57 64	RWEN1
BRDYN	58 63	BEXCN
RESETN	59 62	CLK
DGND	60 61	DGND

Table 5-33: Expansion connector J9 Pin-out

FUNCTION	CONNECTOR PIN	FUNCTION
DGND	1 60	DGND
CB6	2 59	CB7
CB4	3 58	CB5
CB2	4 57	CB3
CB0	5 56	CB1
	6 55	
	7 54	
	8 53	
	9 52	
DGND	10 51	DGND
+3.3V	11 50	+3.3V
GENIO72	12 49	
	13 48	
	14 47	
	15 46	
	16 45	
	17 44	
	18 43	
	19 42	
DGND	20 41	DGND
+3.3V	21 40	+3.3V
	22 39	
	23 38	
	24 37	
	25 36	
	26 35	
	27 34	
	28 33	
	29 32	
DGND	30 31	DGND

Table 5-34: Expansion connector J11 Pin-out

Name	Function	Type	Description
JP1	CONFIG	4x2 pin 0.1" Header	Header for DSU, PROM and WDOG enable
JP2	ETH_INTR	2 pin 0.1" Header	Enable Disable for Ethernet Interrupt
JP3	CAN_TERM0	2x2 pin 0.1" Header	Header for configuration of Termination of CAN0 i/f
JP4	CAN_TERM1	2x2 pin 0.1" Header	Header for configuration of Termination of CAN1 i/f
JP5	ADC_SIGS	34 pin (17x2) 0.1" HDR	Pin connections for optional ADC Mezzanine
JP6	FIFO_SIGS	26 pin (13x2) 0.1" HDR	Pin connections for External FIFO interface
JP7	GPIO_SIGS	26 pin (13x2) 0.1" HDR	Pin connections for GPIO signals 0 to 23
JP8	ROM_SELECT	2x2 pin 0.1" Header	Header for configuration of EEPROM/FLASH
JP9	RAM_BANK	4x2 pin 0.1" Header	Header for configuration of RAM bank select
JP10	ADC_ENABLE	4x2 pin 0.1" Header	Header to (dis)connect on-board ADC functionality
JP11	ASIC_TEST	3x2 pin 0.1" Header	Header for ASIC Scan Test signals
JP12	FP_LEDS	4x2 pin 0.1" Header	Header to connect or front panel LED's
JP13	VIN_SELECT	3pin 0.1" Header	Install jumper in position 1-2 for use with +5V main power input is to be used to generate +3.3V on board and +1.8V (Vcore).  Connect 2-3 if 3.3V PCI power is to be used to provide +3.3V on board and to generate +1.8V (Vcore).
JP14	PIO[15..0]	34 pin (17x2) 0.1" HDR	Pin connections for PIO signals 0 to 15
JP15	3.3V_SELECT	3 pin 0.1" Header	Install same as JP13
JP16	+12V_SELECT	3 pin 0.1" Header	Install jumpers 1-2 for on-board +12V, or 2-3 if +12V is to be supplied from CPCI backplane
JP17	-12V_SELECT	3 pin 0.1" Header	Install jumpers 1-2 for on-board -12V, or 2-3 if -12V is to be supplied from CPCI backplane
JP18	I3V3	2 pin 0.1" Header	Measure point for 3.3V current (Link normally installed)
JP19	RESET_BREAK	2x2 pin 0.1" Header	Pins for Front Panel RESET and BREAK switches
JP20	I1V8	2 pin 0.1" Header	Measure point for 1.8V current (Link normally installed)
JP21	UART_ENABLE	8x2 pin 0.1" Header	Header to (dis)connect on-board UART functionality
JP22	SPWCLKCNFG	8x2 pin 0.1" Header	Header for configuration of SPW CLK configuration
JP23	SPW_CLK	2 pin 0.1" Header	Header to connect ASIC clock as SPW_CLK
JP24	CAN0_LED	2 pin 0.1" Header	Header for front-panel CAN-0 enable LED indicator
JP25	CAN1_LED	2 pin 0.1" Header	Header for front-panel CAN-0 enable LED indicator

Table 5-35: List and definition of PCB Jumpers

(for details refer to schematic)

FUNCTION	CONNECTOR PIN	FUNCTION
ADDATA15	1	ADDATA14
ADDATA13	3	ADDATA12
ADDATA11	5	ADDATA10
ADDATA9	7	ADDATA8
ADDATA7	9	ADDATA6
ADDATA5	11	ADDATA4
ADDATA3	13	ADDATA2
ADDATA1	15	ADDATA0
ADADDR7	17	ADADDR6
ADADDR5	19	ADADDR4
ADADDR3	21	ADADDR2
ADADDR1	23	ADADDR0
ADTRIG	25	ADRDY
ADCS	27	ADRC
ADWR	29	DGND

Table 5-36: ADC\_SIGS Header, JP5 pin-out

FUNCTION	CONNECTOR PIN	FUNCTION
FIFOHALFN	1	FIFOEMPTYN
FIOFULLN	3	FIOFWRN
FIFORDN	5	FIFOP1
FIFOP0	7	FIFOD15
FIFOD14	9	FIFOD13
FIFOD12	11	FIFOD11
FIFOD10	13	FIFOD9
FIFOD8	15	FIFOD7
FIFOD6	17	FIFOD5
FIFOD4	19	FIFOD3
FIFOD2	21	FIFOD1
FIFOD0	23	RESETN
+3.3V	25	DGND

Table 5-37: FIFO\_SIGS Header, JP6 pin-out

FUNCTION	CONNECTOR PIN	FUNCTION
GPIO23	1	GPIO22
GPIO21	3	GPIO20
GPIO19	5	GPIO18
GPIO17	7	GPIO16
GPIO15	9	GPIO14
GPIO13	11	GPIO12
GPIO11	13	GPIO10
GPIO9	15	GPIO8
GPIO7	17	GPIO6
GPIO5	19	GPIO4
GPIO3	21	GPIO2
GPIO1	23	GPIO0
DGND	25	DGND

Table 5-38: GPIO\_SIGS Header, JP7 pin-out

Name	Function	Description
X1	OSC_MAIN	Main oscillator for ASIC DIL8, 3.3V (30MHz as standard)
X2	OSC_ETH	Oscillator for Ethernet PHT transceiver, SMMD type, 3.3V, 25.000MHz
X3	OSC_SPW	DIL8 socket for user installed SPW Clock Oscillator
X4	OSC_TIME	DIL8 socket for user installed TIME Clock Oscillator

Table 5-39: List and definition of Oscillators

Name	Function	Description
D1	POWER (3.3V)	Power indicator
D2	ERRORN	Leon processor in 'ERROR' mode
D3	DSUACT	Leon Debug Support Unit 'Active'
D4	WDOG	Watchdog indicator.
D5	PROM_BUSY	Prom Write/Erase in Progress
D6	CAN-A	CAN interface A enabled
D7	CAN-B	CAN interface B enabled
D14	USB-RX	Indicates activity on USB RX data
D15	USB-TX	Indicates activity on USB TX data

Table 5-40: List and definition of PCB mounted LED's



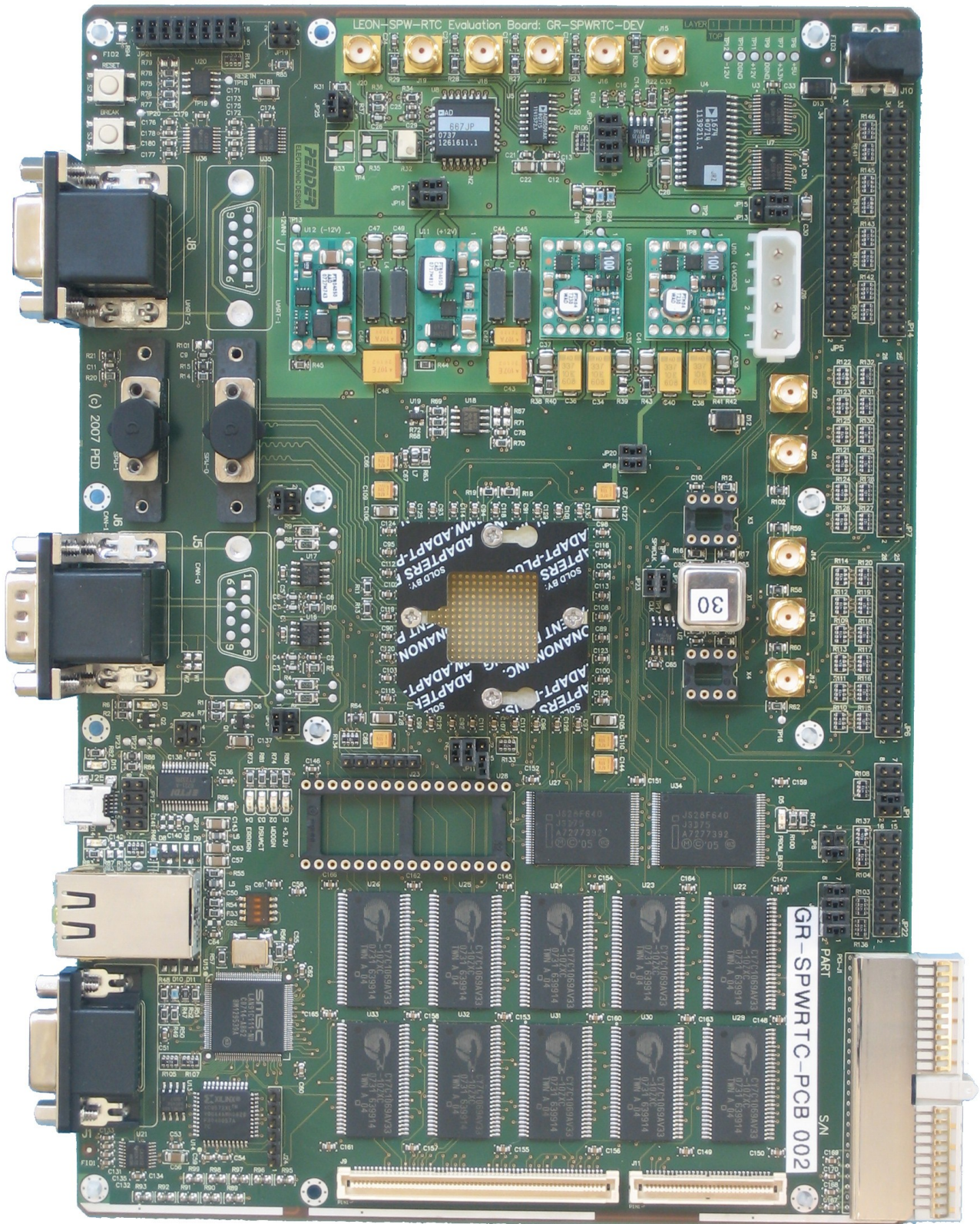


Figure 5-2: Main PCB Top View

